Quest for balance in radiation leads to lower doses

April 10 2017

A new study led by UC San Francisco has found that radiation doses can be safely and effectively reduced - and more consistently administered - for common CT scans by assessing and comparing doses across hospitals, and then sharing best practices for how much radiation to use.

While there has been a steady rise in the use of computed tomography (CT) in the United States over the last decade, doses of radiation vary substantially between hospitals, with few concrete standards on best dose levels. As a result, medical experts have difficulty determining the "right" dose of radiation that balances diagnostic accuracy, while minimizing the radiation exposure that increases cancer risk for patients. Without a consistent standard, each institution generally makes independent decisions about what dose to use.

A new project at the five academic medical centers of the University of California introduced a feedback system for radiologists on their doses and sought to study its effectiveness in reducing excess radiation exposure. The program consisted of auditing radiology professionals at each medical center and providing feedback on how these doses compared to those used at the other medical centers, while systematically sharing best practices. Included in the project were section chiefs of radiology, medical physicists and radiology technicians.

The project resulted in substantially lower radiation doses for chest and abdominal scans as well as more consistent radiation doses for head scans, according to the study which appears April 10 in *JAMA Internal*

Medicine.

"We estimate that if the improvements we saw were applied to all abdominal CT scans performed in the U.S., this would result in the reduction of approximately 12,000 cancers annually," said senior author Rebecca Smith-Bindman, MD, a professor in the UCSF departments of radiology, and of epidemiology and biostatistics, and the Philip R. Lee Institute of Health Policy Studies. Smith-Bindman also directs the Radiology Outcomes Research Laboratory.

"Reducing unnecessary and inconsistent radiation doses is an extremely important process for improving patient safety," she said. "We found that providing detailed and comparative feedback, and sharing best practices on how each institution was able to optimize their dose, leads to lower and more consistent CT doses. In short, it makes no sense for each institution to have to re-invent the wheel regarding how to optimize doses - this project focuses on helping the leaders at each institution learn from each other."

The American College of Radiology and other organizations advocate that CT scans be performed with radiation exposures that are as low as can be reasonably achieved. But in the absence of explicit guidelines, CT radiation doses vary widely, leading to unnecessary radiation exposure for some patients.

To help optimize radiation exposure and shift toward dose standardization, the authors of the new study collected information on all diagnostic CT examinations - amounting to more than 158,000 CT scans - performed between Oct. 1, 2013, and Dec. 31, 2014, at the five medical centers composing UC Health: UC Davis, UC Irvine, UC Los Angeles, UC San Diego and UC San Francisco.

The authors then created reports for chest, abdomen and head CT scans,

provided those reports to individuals at each medical center, and then met in person to discuss the findings. During the meetings, each medical center shared strategies on lowering radiation doses without affecting diagnostic performance, including both successful and failed approaches. The collaborators then shared and implemented what they had learned with their own medical centers.

The authors found that by reviewing doses and sharing best practice procedures, the mean effective radiation dose for standard chest CT scans could be reduced by nearly 19 percent, and for abdominal CT scans, the mean dose could be lowered by 25 percent. For head CT scans, doses varied less over time, the authors reported. CT scans of the chest, abdomen and head account for more than 80 percent of all CT imaging performed at the medical centers, so the improvements were substantial.

"These findings indicate a benefit to reviewing institutional radiation doses, providing feedback to radiology practices using an easy and comprehensive format, and bringing professionals together to discuss strategies for improvement," said Smith-Bindman.

"While our study team provided the leadership, the hard work of improving, optimizing and standardizing radiation doses was performed by the University of California technologists, radiologists and medical physicists who were all committed to improving the care they provided."

Among several study limitations, the authors said that a randomized trial, rather than an observational study, could provide "more definitive evidence of the association between dose feedback and dose." Smith-Bindman has been funded by the National Institutes of Health to conduct a randomized trial, which is underway.

An accompanying commentary in the same issue of *JAMA Internal*

Medicine concluded that the study provides a valuable roadmap for hospitals and other treatment facilities. While previous radiation improvement programs have fallen short, this "robust" approach succeeded, the commentary noted, in part because medical experts were given authority and accountability to implement appropriate changes.

"By creating a venue for leaders from the five institutions to collectively define and standardize best practices, with allowance for flexibility within each institution...the study team hypothesized that greater reductions (and less variation) in radiation exposure could be achieved. And they were right," wrote the authors of the commentary.

The commentary's corresponding author was Ralph Gonzales, MD, MSPH, associate dean for clinical innovation and chief innovation officer for UCSF Health.

The commentary pointed out several remaining questions: what specific changes were made at each institution that achieved the reductions and whether the radiation reductions led to changes in diagnostic accuracy. "This will certainly be a factor for future institutions to consider," they wrote.

Provided by University of California, San Francisco